RESTRICTED CIRCULATION

THIS PAPER IS NOT AN OFFICIAL DOCUMENT; IT IS FOR INFORMATION ONLY AND MUST NOT BE QUOTED IN ANY PRINTED PUBLICATION

Agricultural Memorandum 814

Eyespot in Winter Wheat

J SEAGER AND M N HOUGH

The results of Mrs Seager's work on Eyespot were not made generally known and the purpose of this memorandum is to set out her results unabridged and to include further information which has come to light since.

Eyespot, 1974, 75 and 76 by J Seager (in absentia)

Use of accumulated temperatures

The temperature range for the activity of the eyespot fungus is about 5°C - 20°C with an optimum around 10°C. Accumulated temperatures above 6°C are used to indicate the level of this activity, being calculated from 1 November until about the end of April.

The data

Trials were carried out in 1974 and 1975 at sites in Lincolnshire. These trial sites are close to Cranwell and so meteorological data from Cranwell are used.

Analysis

Taking the results from 1975, the best spray date was April 30. Spraying on this day reduced the total eyespot from 87% to 49%, and the severe eyespot from 12% to 2%. The fact that 49% of the tillers showed eyespot lesions indicates that infection had already taken place, but secondary infection was prevented. In fact, looking at the sampling data, eyespot was already present to a large extent on 3 April. The accumulated temperature above 6°C totalled from 1 November to the day of the best spray, 30 April, was 250 day degrees C. If this was indeed the secondary infection, the primary infection took place at 125 day degrees C. This total was reached on 25 January and would account for the amount of eyespot at the first sampling date of 3 April. There was a rainfall of 7.7 mm on 26 January.

Applying this idea to the results of 1974, the total accumulated temperature for the 1st infection to occur, 125 day degrees C, was reached on 19 March. The spray applied on 18 March could have affected some of the earlier eyespot. By the date of the most successful spray, 18 April, the total accumulated temperature was 177 day degrees C. This figure is not large enough for the secondary infection to have occurred. Examination of rainfall data from 19 March onwards shows that the only fall of rain greater than 3 mm was on 11 April, with no more rain until after 18 April. Rainfall may be needed for the primary infection to occur after the spores have been produced. The spray on 18 April prevented this infection.

The total of 250 day degrees C was reached on May 16. On this day the maximum

temperature was 19.7°C, 20.1°C on the following day. Temperatures above 20°C are unfavourable for the eyespot fungus and so it is assumed that infection ceases at these temperatures. Since the spray applied on 18 April was so effective, no further infections occurred.

(It may be necessary to count another 125 day degrees for the secondary infection from the date of the primary infection, ie after the rainfall).

Conclusion

125 day degrees C of accumulated temperature above 6°C are required from 1 November for incubation of spores. Rain is required to transfer spores from the soil to the tillers where infection takes place. Secondary infection occurs after a further 125 day degrees C. Rain is not required to produce secondary infections on the same tiller, which cause severe lesions. Temperatures above 20°C are harmful to the eyespot fungus.

Applying notes to 1976 data:

125 day degrees C from November 1 was reached on 5 March. Rainfall was 0.2 mm on 8th, 2.6 mm on 11th, 6.0 mm on 12th.

250 day degrees C reached on 7 May. Max temperature on 7th 21.2°C on 8th, 20.6°C on 9th 20.3°C.

Thus an ideal spray date should have been around 13 March.

The data showed that sprays applied on 23 March, 8 and 22 April gave similar results with the spray on 5 May having the most effect.

Further Comments (M N Hough)

Suggested life history and environmental effects

1. Fungus survives on stubble either as spores or MYCELIUM. Rowe and Powelson say that mature MYCELIUM produces heavy sporulation after 2 weeks incubation with "daily thermal sporulation coefficient" (DTSC) of 120 or more. This comes out as 70°C days above 0°C, and would not appear to be the minimum requirement. The MYCELIUM on stubble would be damp much of the time during and after November so that spores could be produced from December onwards.

According to Seager (this memo) 125°C days above 6°C are needed to incubate spores. No other workers seem to have determined this requirement save to say that incubation is long (about 6 to 8 weeks).

Therefore we need to know if the fungus carries over from one wheat crop to the next as spores or as mature MYCELIUM.

2. Sporulation

Schrodter and Fehrmann gave the optimum for spore production in the field as 3-4°C, but Rowe and Powelson's laboratory experiments showed sporulation to be greatest near 10°C with 0°C as a lower limit and temperatures above 20°C as detrimental to spore production.

3. Infection

Spore release is probably due to rain splash, but high humidity alone may be sufficient. Infection requires moisture and temperatures in the range 4 to 13°C with the optimum at 8 or 9°C. The Germans regard that severe infection follows if such temperatures are observed for 15 hours with relative humidity above 80%.

4. Penetration

Host penetration increases with temperatures in the range 6 to 18°C.

5. Continuous sporulation under optimum conditions eventually causes much reduced spore production after about 50 days.

6. The wheat plants become more resistant to attack as they mature.

The Germans have developed a spray warning system based on meteorological data which places the best spray date as after the major sporulation period in Spring. It is hoped to test this system this year.

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
Bracknell

February 1977